

What is claimed is:

1. A method of separating gaseous alkene selected from the group consisting of ethylene, propylene and mixtures thereof, from a gaseous mixture including the alkene and a sulfur compound, the method comprising the steps of:

contacting the gaseous mixture with an adsorbent which preferentially adsorbs the alkene, at a selected temperature and pressure, thereby producing a non-adsorbed component and an alkene-rich adsorbed component; the adsorbent comprising a carrier having a surface area, the carrier having a monolayer of a silver compound dispersed on substantially the entire surface area, the silver compound releasably retaining the alkene; and the carrier comprising a plurality of pores having a pore size greater than the effective molecular diameter of the alkene; and

changing at least one of the pressure and temperature to thereby release the alkene-rich component from the adsorbent;

wherein the adsorbent substantially maintains its adsorbent capacity and preference for the alkene in the presence of the sulfur compound.

2. The method as defined in claim 1 wherein the silver compound is silver nitrate ( $\text{AgNO}_3$ ) and the carrier is silica ( $\text{SiO}_2$ ).

3. The method as defined in claim 1 wherein the silver compound is a silver salt, and wherein the salt is selected from the group consisting of acetate, benzoate, bromate, chlorate, perchlorate, chlorite, citrate, fluoride, nitrate, nitrite, sulfate, and mixtures thereof.

4. The method as defined in claim 1 wherein the carrier has a BET surface area greater than about 50

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1           10. The method as defined in claim 1 wherein  
2    the retaining of the alkene is accomplished by formation

3 of  $\pi$ -complexation bonds between the silver compound and  
4 the alkene.

11. A sulfur tolerant adsorbent for  
preferential adsorption of gaseous alkene from a gaseous  
mixture including the alkene and a sulfur compound, the  
adsorbent comprising:  
a carrier; and  
a silver compound supported on the carrier,  
wherein the silver compound is a silver salt, and wherein  
the salt is selected from the group consisting of  
acetate, benzoate, bromate, chlorate, perchlorate,  
chlorite, citrate, fluoride, nitrate, nitrite, and  
sulfate;  
wherein the carrier has a BET surface area  
greater than about 50 square meters per gram and up to  
about 2,000 square meters per gram and comprising a  
plurality of pores having a pore size greater than about  
3 angstroms and up to about 10 microns;  
and wherein the adsorbent substantially  
maintains its adsorbent capacity and preference for the  
alkene in the presence of the sulfur compound.

12. The adsorbent as defined in claim 11  
wherein the adsorbent comprises finely divided particles  
of silica ( $\text{SiO}_2$ ) with silver nitrate ( $\text{AgNO}_3$ ) dispersed on  
and supported on the particles.

13. The adsorbent as defined in claim 11  
wherein the carrier is selected from the group consisting  
of refractory inorganic oxide, molecular sieve, and  
activated carbon in particle form.

14. The adsorbent as defined in claim 13  
wherein the refractory oxide is selected from the group  
consisting of pillared clay, alumina and silica.

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15. A method for separating a diene from a mixture including the diene and a sulfur compound, the process comprising the step of:

contacting the mixture with an adsorbent which preferentially adsorbs the diene, at a selected temperature and pressure, thereby producing a non-adsorbed component and a diene-rich adsorbed component, wherein the adsorbent comprises an ion-exchanged zeolite selected from the group consisting of zeolite X, zeolite Y, zeolite LSX, and mixtures thereof, the zeolite having exchangeable cationic sites, and a majority of the sites having (silver) cation or (copper) cation present, and wherein the preferential adsorption occurs by  $\pi$ -complexation, and further wherein the adsorbent substantially maintains its adsorbent capacity and preference for the diene in the presence of the sulfur compound.

16. The method as defined in claim 15 wherein the diene is selected from the group consisting of butadiene, hexadiene, octadiene and mixtures thereof, and wherein the method further comprises the step of changing at least one of the pressure and temperature to thereby release the diene-rich component from the adsorbent.

17. The method as defined in claim 15 wherein the diene is 1,3-butadiene, and wherein the mixture includes 1,3-butadiene and at least one other  $C_4$  unsaturated compound.

18. The method as defined in claim 15 wherein the majority of the cationic sites of the ion-exchanged zeolite contain the silver cation.

19. The method as defined in claim 15 wherein the majority of the cationic sites of the ion-exchanged zeolite contain the copper cation.

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1           20. The method as defined in claim 15 wherein  
2 the mixture comprises at least one mono-olefin having as  
3 many carbon atoms as the diene, wherein the diene is  
4 selected from the group consisting of butadiene,  
5 hexadiene, octadiene, and mixtures thereof; and wherein  
6 the mono-olefin is selected from the group consisting of  
7 butene, hexene, octene, and mixtures thereof.

1           21. The method as defined in claim 20 wherein  
2 the mono-olefin is butene and the diene is butadiene.

1           22. The method as defined in claim 20 wherein  
2 the mixture comprises the mono-olefin in a gaseous state  
3 and saturated with the diene.

1           23. The method as defined in claim 15 wherein  
2 essentially all cationic sites of the ion-exchanged  
3 zeolite contain the silver cation.

1           24. The method as defined in claim 16 wherein  
2 the selected pressure of preferential adsorption is a  
3 first pressure, and the pressure of release is a second  
4 pressure less than the first pressure, wherein the first  
5 pressure is in a range of about 1 atmosphere to about 35  
6 atmospheres, and wherein the second pressure is in a  
7 range of about 0.01 atmosphere to about 5 atmospheres.

1           25. The method as defined in claim 16 wherein  
2 the selected temperature of preferential adsorption is a  
3 first temperature, and the temperature of release is a  
4 second temperature greater than the first temperature,  
5 wherein the first temperature is in a range of about 0°C  
6 to about 150°C, and wherein the second temperature is in  
7 a range of about 70°C to about 250°C.

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1           30. The method as defined in claim 11 wherein  
2    the sulfur compound is hydrogen sulfide, and wherein the

3 hydrogen sulfide is present in amounts up to about 66  
4 mole%.

1  
2 31. The method as defined in claim 15 wherein  
3 the sulfur compound is hydrogen sulfide, and wherein the  
4 hydrogen sulfide is present in amounts up to about 66  
mole%.

1  
2 32. The method as defined in claim 26 wherein  
3 the sulfur compound is hydrogen sulfide, and wherein the  
4 hydrogen sulfide is present in amounts up to about 66  
mole%.

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